October 19, 2005

To: Christine Hempleman, TMDL Lead

From: Lawrence Sullivan, TMDL Bacteria Field Lead
Subject: Oakland Bay TMDL Quarterly Progress Report
(November through August 2005)

Introduction

Oakland Bay, Hammersley Inlet, and several of their tributaries were placed on the federal 303(d) list (1996, 1998, and proposed 2002/2004) for not meeting state water quality standard for fecal coliform bacteria. Therefore, in accordance with the Federal Clean Water Act, total daily maximum loads (TMDLs) for fecal coliform bacteria must be established to bring these waterbodies into compliance with water quality standards. The field work for the study began in November 2004 to assess the current condition of the waterbodies and to identify and quantify factors contributing to the impairments.

This memorandum summarizes the progress from November 2004 through August 2005 related to data collection and project communications. Data presented are provisional; data quality has not been checked.

Progress to Date

Bacteria Data Collection

Bi-monthly sampling of 27 sites on the major tributaries draining to Oakland Bay and Hammersly Inlet began in November 2004 and will continue through November 2005. The streams that are sampled include: Mill Creek, Goldsborough Creek, Coffee Creek, Shelton Creek, John's Creek, Cranberry Creek, Deer Creek, Malaney Creek, Uncle John's Creek, and Campbell Creek. Typically, staff members from the Squaxin Island Tribe sample the first run of the month and employees of the Department of Ecology sample the second run of the month.

The tributaries to Oakland Bay and Hammersly Inlet are classified as Class A waterbodies. The water quality standard for fecal coliform bacteria in these streams states that the geometric mean of samples can not exceed 100 cfu/100 mL of water and the 90^{th} percentile of samples taken can not exceed 200 cfu/100 mL of water. During the sampling period ending in August 2005, Shelton Creek, Deer Creek, and Uncle John's Creek have sites that are exceeding the water quality standard. All three are exceeding the 90^{th} percentile portion of the standard and not the geometric mean. Site SHE 1 (Shelton Creek at Highway 3 bridge) has a 90^{th} percentile value of 225 cfu/100ml (Figure 4). DEE 1 (Deer Creek at Highway 3 bridge) has a 90^{th} percentile value of 245 cfu/100ml (Figure 7). Uncle John's Creek has two sites that are exceeding the water quality standard for fecal coliform, UNC 1 (Uncle John's Creek at the culvert on Agate Loop Road) and UNC 2 (Uncle John's Creek at the intersection of Agate Loop Road and Daniels

Road). UNC 1 has a 90th percentile value of 439 cfu/100mL and UNC 2 has a 90th percentile value of 336 cfu/100mL (Figure 9).

The Department of Ecology has also accompanied the Department of Health on their sampling runs on Oakland Bay and Hammerlsy Inlet. On each run, the Department of Ecology sampled a portion of the Department of Health's sites and took CTD (conductivity, temperature, and depth) readings. All of Hammersly Inlet and most of Oakland Bay are classified as Class A waterbodies. Marine water quality standard for fecal coliform bacteria in these waterbodies states that the geometric mean of samples can not exceed 14 cfu/100 mL of water and the 90th percentile of samples taken can not exceed 43 cfu/100 mL of water. The Inner Shelton Harbor of Oakland Bay is classified as Class B, with a water quality standard of 100 cfu/100mL for the geometric mean and 200 cfu/100mL for the 90th percentile.

The Inner Shelton Harbor Site OAKSH2 is exceeding the 90th percentile portion of the water quality standard. OAKSH2 has a 90th percentile value of 335 cfu/100ml (Figure 11). Site OAK128 in the mouth of Chapman Cove is also exceeding the 90th percentile portion of the water quality standard with a 90th percentile value of 209 cfu/100ml (Figure 11). All Hammersly Inlet sites are meeting the water quality standard. This data summarized is from November 2004 through June 2005 and includes only Department of Ecology results, not those from the Department of Health.

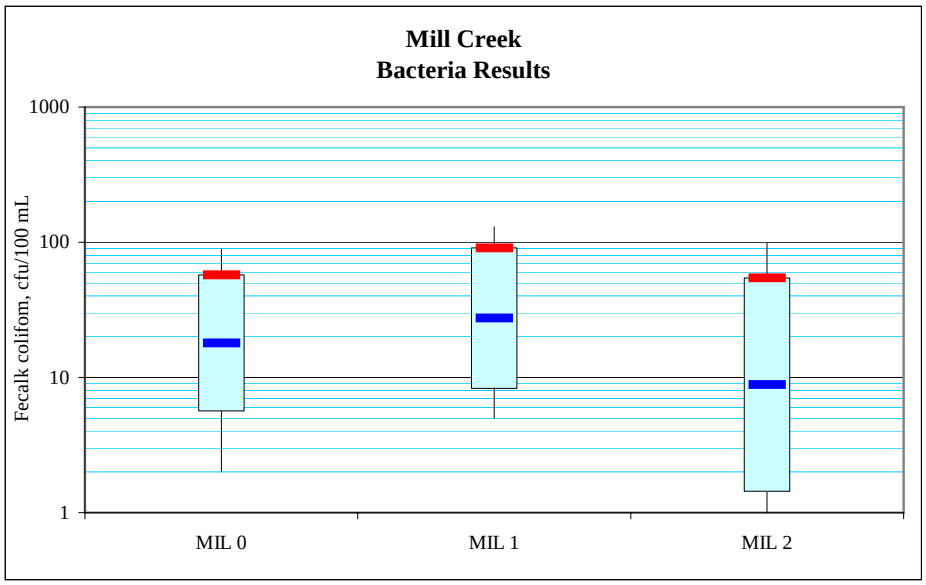
On September 21st, 2004 the shorelines of Oakland Bay and Hammersly Inlet were surveyed for small drainages and/or discharge points in addition to the major tributaries that may contribute pollution to the marine waterbodies. These include storm water culverts, unnamed tributaries, and direct runoff points from agricultural activities. 279 drainage points were found and mapped (Figure 12). These sites were then sampled on February 14th and 15th, 2005. Only the drainage points that were conveying water on those days were sampled. Out of the 142 drainages that were running, only 10 had fecal coliform concentrations greater than 100 cfu/100 mL. Two sites were located in the upper portion of Oakland Bay, one on the northwest shore and one near the mouth of Deer Creek. Another site was located just south of Chapman Cove (Figure 13) and the remaining sites were located on southern shoreline of Inner Shelton Harbor and the southern shoreline of Hammersly Inlet.

Many of the waterbodies were also equipped with monitoring equipment to assist in the model calibration for Oakland Bay and Hammersly Inlet. Mill Creek, Goldsborough, Coffee Creek, Shelton Creek, John's Creek, Cranberry Creek, Deer Creek, Malaney Creek, Uncle John's Creek, and Campbell Creek all received temperature sensors on October 20, 2004 to monitor stream temperature throughout the duration of the study. Tide and current meters were also placed in Oakland Bay and Hammersly Inlet on January 13, 2005 and will remain throughout the study (Figure 14). An ADCP (acoustic Doppler current profiler) was also placed at the headwaters of Hammersly Inlet from January 13, 2005 to April 19, 2005.

Communication and Coordination

- Monthly sample coordination meetings with Squaxin Island Tribe.
- Monthly sample coordination meetings with Department of Health.
- Met with Mason County Department of Health to discuss sampling on October 21, 2005.
- Initial DOE planning meeting for shoreline survey on January 19, 2005.
- Planning meeting for shoreline survey with Squaxin Island Tribe on January 26, 2005.
- Met with Department of Health to discuss Oakland Bay data on January 27, 2005.
- Volunteer training for shoreline survey on January 31, 2005.
- Met with Squaxin Island Tribe to discuss Oakland Bay data on April 25, 2005.
- Oakland Bay reclassification meeting on September 21, 2005.

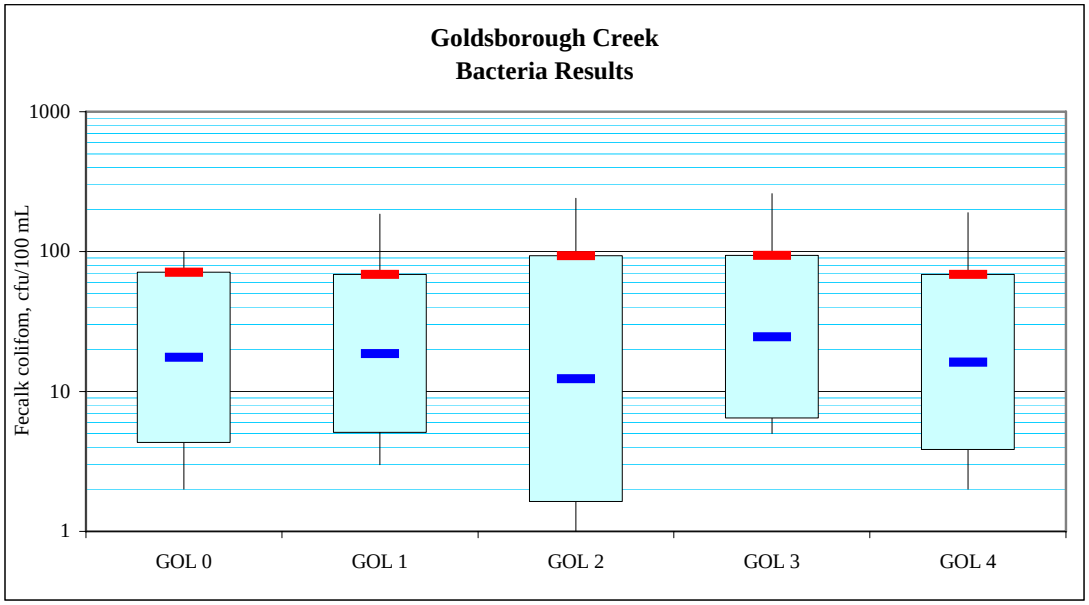
Figures and Tables



Date	MIL 0	MIL 1	MIL 2	Rainfall (Previous 24 hrs)
11/22/2004	17	10	8	0.01
12/8/2004	29	42	12	0.44
12/21/2004	26	30	8	0
1/4/2005	9	17	7	0
1/18/2005	80	130	42	1.25
2/18/2005	8	13	3	0
3/1/2005	40	28	1	0.1
3/8/2005	2	8	1	0
3/23/2005	9	11	1	0.04
4/5/2005	9	5	1	0.22
4/18/2005	8	9	3	0.26
5/3/2005	17	27	6	0.29
5/17/2005	89	120	38	0.14
5/31/2005	18	49	21	0
6/14/2005	29	29	39	0.06
6/27/2005	9	24	25	0
7/5/2005	12	36	21	0
7/18/2005	38	94	22	0
8/1/2005	24	47	20	0
8/15/2005	41	84	98	0

MIL 0	MIL 1	MIL 2	Statistic
6	8	1	10th percentile
2	5	1	min
18	27	9	geometric mean
89	130	98	max
57	91	55	90th percentile

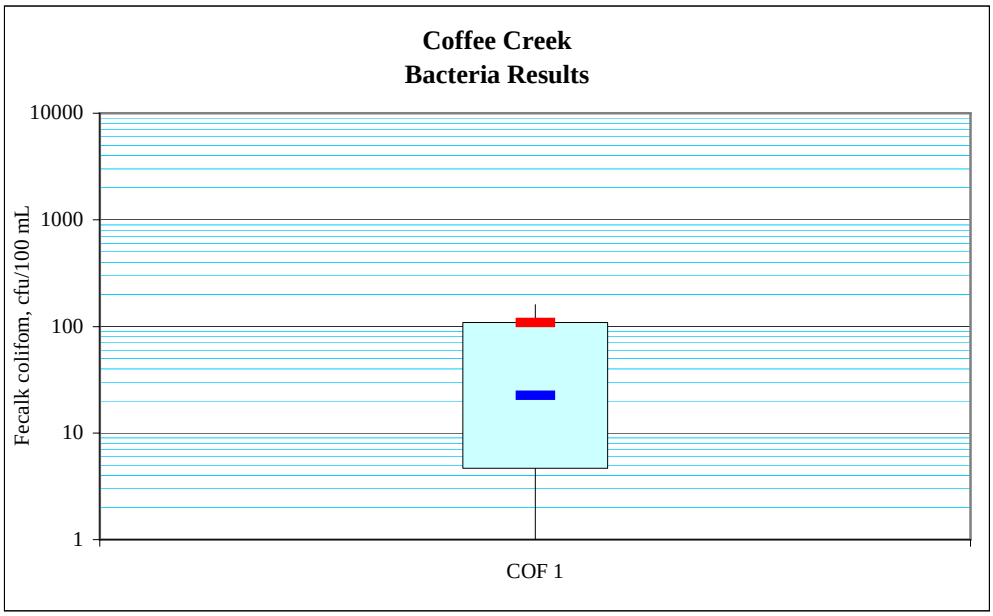
Figure 1. Mill Creek Fecal Coliform Results



Date	GOL 0	GOL 1	GOL 2	GOL 3	GOL 4
11/22/2004	2	7	4	8	5
12/8/2004	35	40	38	30	31
12/21/2004	7	12	4	8	2
1/4/2005	6	10	1	14	16
1/18/2005	100	185	240	130	48
2/18/2005	5	3	1	5	11
3/1/2005	49	59	77	110	31
3/8/2005	5	5	2	31	190
3/23/2005	5	7	5	9	7
4/5/2005	11	7	18	2	9
4/18/2005	20	14	7	16	5
5/3/2005	23	18	15	29	32
5/17/2005	32	21	15	37	7
5/31/2005	25	14	6	25	17
6/14/2005	32	36	56	23	11
6/27/2005	29	19	19	29	24
7/5/2005	51	43	47	260	23
7/18/2005	34	25	28	20	29
8/1/2005	43	35	53	21	63
8/15/2005	24	40	25	22	23

GOL 0	GOL 1	GOL 2	GOL 3	GOL 4	Statistics
5	5	2	5	5	10th percentile
2	3	1	2	2	min
18	18	13	22	17	geometric mean
100	185	240	260	190	max
67	64	89	92	64	90th percentile

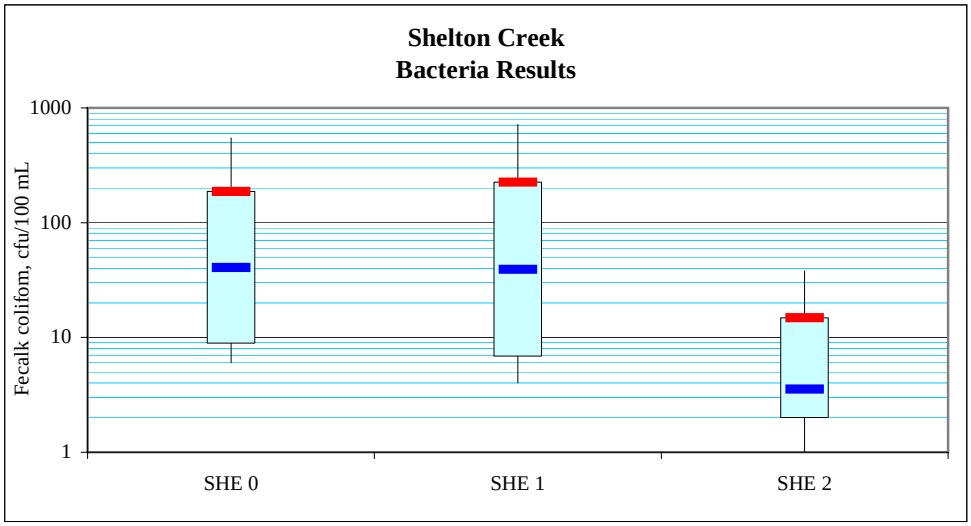
Figure 2. Goldsborough Creek Fecal Coliform Results



Date	COF 1	Rainfall (Previous 24 hrs)
11/22/2004	6	0.01
12/8/2004		0.44
12/21/2004	39	0
1/4/2005	1	0
1/18/2005	160	1.25
2/18/2005	42	0
3/1/2005	44	0.1
3/8/2005	6	0
3/23/2005	6	0.04
4/5/2005		0.22
4/18/2005	8	0.26
5/3/2005		0.29
5/17/2005	45	0.14
5/31/2005	25	0
6/14/2005	43	0.06
6/27/2005	33	0
7/5/2005	30	0
7/18/2005	34	0
8/1/2005	85	0
8/15/2005	36	0

COF 1	Statistic
5	10th percentile
1	min
23	geometric mean
160	max
109	90th percentile

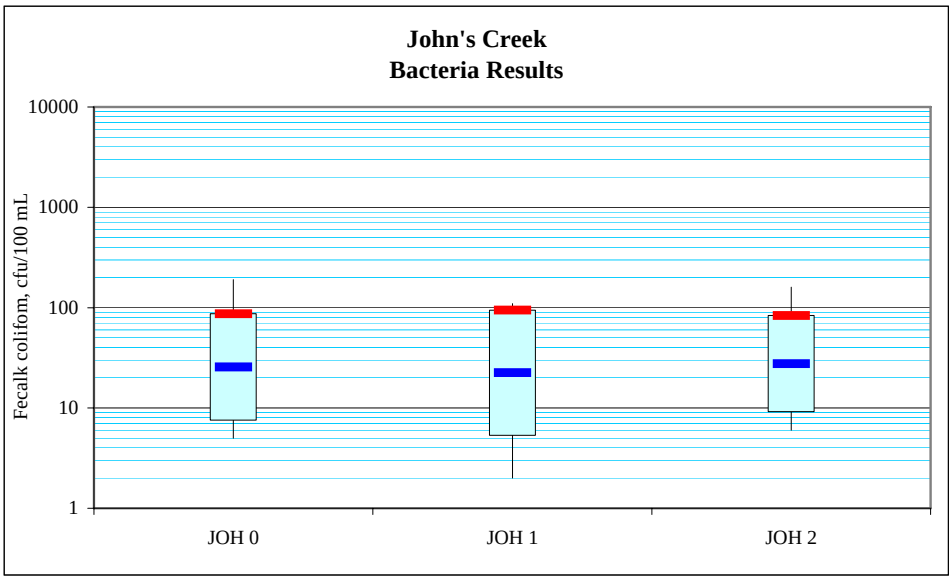
Figure 3. Coffee Creek Fecal Coliform Results



Date	SHE 0	SHE 1	SHE 2	Rainfall (Previous 24 hrs)
11/22/2004	13	10	2	0.01
12/8/2004	73	250	3	0.44
12/21/2004	19	20	4	0
1/4/2005	11	10	1	0
1/18/2005	180	250	38	1.25
2/18/2005	11	7	1	0
3/1/2005	12	29	1	0.1
3/8/2005	6	4	1	0
3/23/2005	18	15	7	0.04
4/5/2005	170	110	4	0.22
4/18/2005	18	11	1	0.26
5/3/2005	27	29	1	0.29
5/17/2005	140	60	6	0.14
5/31/2005	60	47	4	0
6/14/2005	84	28	3	0.06
6/27/2005	50	42	14	0
7/5/2005	550	720	24	0
7/18/2005	32	36	4	0
8/1/2005	57	220	3	0
8/15/2005	110	76	13	0

SHE 0	SHE 1	SHE 2	Statistics
9	7	2	10th percentile
6	4	1	min
41	39	4	geometric mean
550	720	38	max
187	225	15	90th percentile

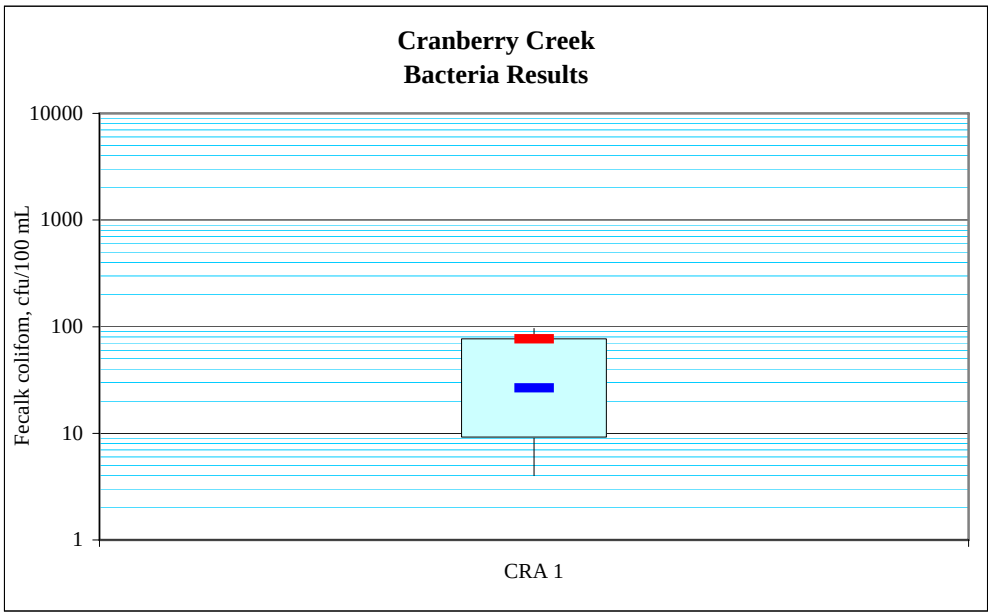
Figure 4. Shelton Creek Fecal Coliform Results



Date	JOH 0	JOH 1	JOH 2	Rainfall (Previous 24 hrs)
11/22/2004	5	2	6	0.01
12/8/2004	35	46	42	0.44
12/21/2004	22	5	15	0
1/4/2005	16	11	17	0
1/18/2005	190	100	160	1.25
2/18/2005	7	10	9	0
3/1/2005	28	34	59	0.1
3/8/2005	11	16	14	0
3/23/2005	9	12	11	0.04
4/5/2005	10	4	11	0.22
4/18/2005	12	12	15	0.26
5/3/2005	14	16	49	0.29
5/17/2005	27	36	22	0.14
5/31/2005	67	43	29	0
6/14/2005	45	80	57	0.06
6/27/2005	43	110	49	0
7/5/2005	55	57	67	0
7/18/2005	35	17	22	0
8/1/2005	120	88	88	0
8/15/2005	48	35	40	0

JOH 0	JOH 1	JOH 2	Statistic
8	5	9	10th percentile
5	2	6	min
26	22	28	geometric mean
190	110	160	max
87	95	83	90th percentile

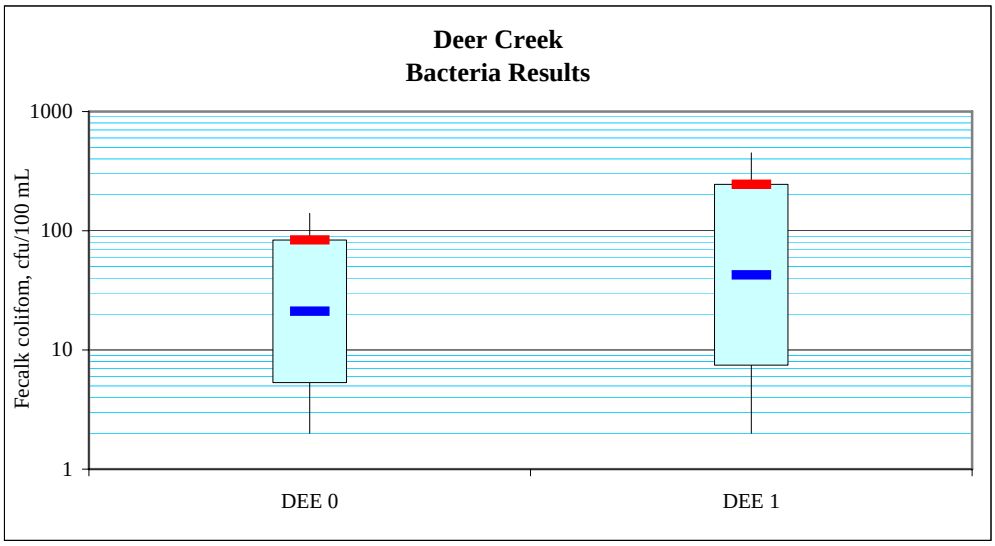
Figure 5. John's Creek Fecal Coliform Results



Date	CRA 1	Rainfall (Previous 24 hrs)
11/22/2004	22	0.01
12/8/2004	38	0.44
12/21/2004	22	0
1/4/2005	11	0
1/18/2005	96	1.25
2/18/2005	15	0
3/1/2005	31	0.1
3/8/2005	24	0
3/23/2005	4	0.04
4/5/2005	9	0.22
4/18/2005	8	0.26
5/3/2005	21	0.29
5/17/2005	27	0.14
5/31/2005	32	0
6/14/2005	74	0.06
6/27/2005	43	0
7/5/2005	36	0
7/18/2005	55	0
8/1/2005	88	0
8/15/2005	51	0

CRA 1	Statistic
9	10th percentile
4	min
27	geometric mean
96	max
77	90th percentile

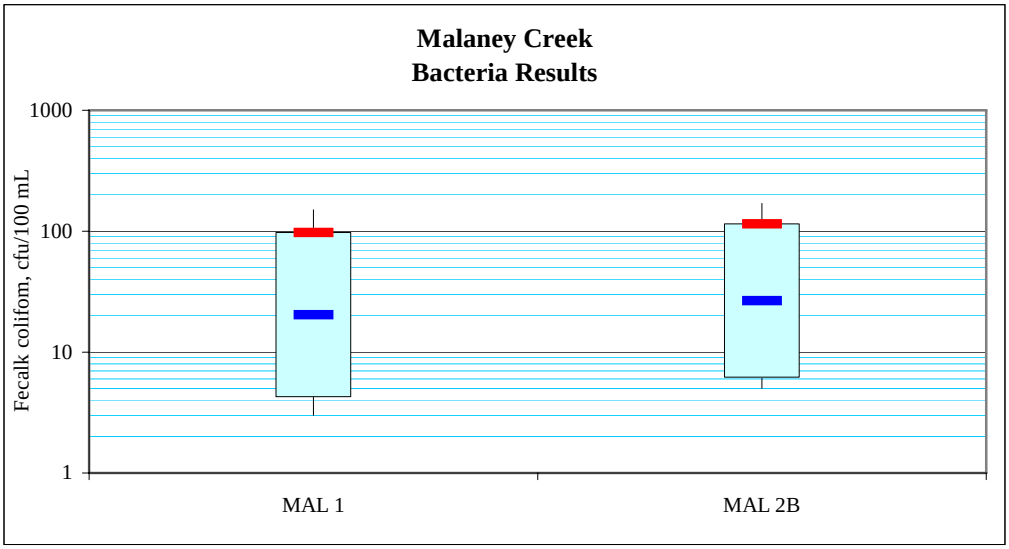
Figure 6. Cranberry Creek Fecal Coliform Results



Date	DEE 0	DEE 1	Rainfall (Previous 24 hrs)
11/22/2004	10	54	0.01
12/8/2004	9	65	0.44
12/21/2004	27	13	0
1/4/2005	14	18	0
1/18/2005	77	150	1.25
2/18/2005	9	28	0
3/1/2005	13	49	0.1
3/8/2005	9	10	0
3/23/2005	5	13	0.04
4/5/2005	2	2	0.22
4/18/2005	8	14	0.26
5/3/2005	32	80	0.29
5/17/2005	37	450	0.14
5/31/2005	25	15	0
6/14/2005	69	22	0.06
6/27/2005	39	110	0
7/5/2005	34	400	0
7/18/2005	140	60	0
8/1/2005	46	92	0
8/15/2005	80	230	0

DEE 0	DEE 1	Statistics
5	7	10th percentile
2	2	min
21	43	geometric mean
140	450	max
84	245	90th percentile

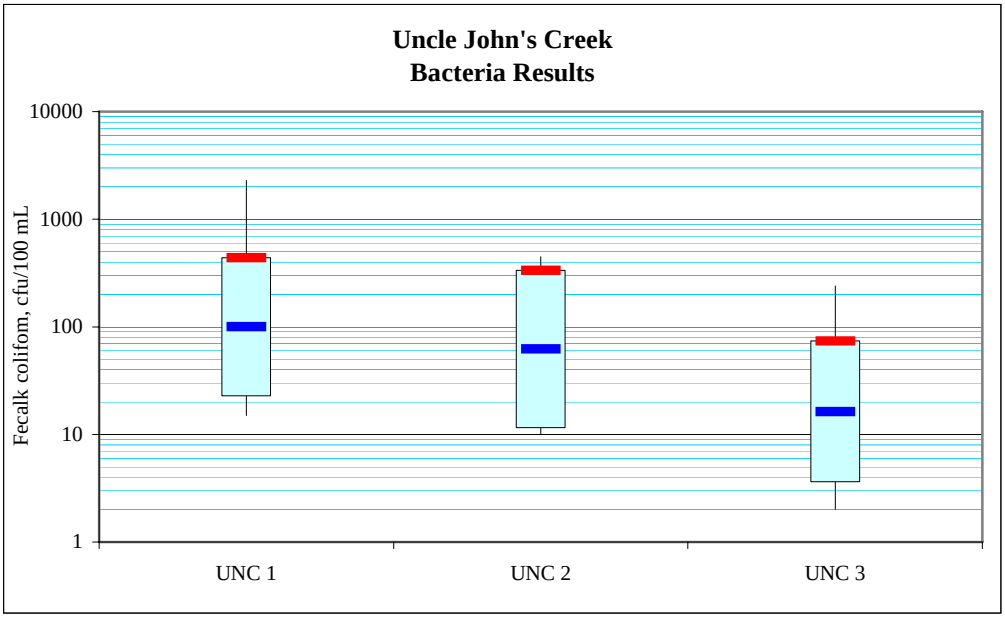
Figure 7. Deer Creek Fecal Coliform Results



Date	MAL 1	MAL 2B	Rainfall (Previous 24 hrs)
11/22/2004	10	6	0.01
12/8/2004	28	24	0.44
12/21/2004	150	90	0
1/4/2005	3	14	0
1/18/2005	110	130	1.25
2/18/2005	9	24	0
3/1/2005	8	29	0.1
3/8/2005	3	8	0
3/23/2005	4	5	0.04
4/5/2005	6	6	0.22
4/18/2005	6	8	0.26
5/3/2005	53	60	0.29
5/17/2005	98	45	0.14
5/31/2005	49	13	0
6/14/2005	29	14	0.06
6/27/2005	43	95	0
7/5/2005	47	80	0
7/18/2005	52	63	0
8/1/2005	23	170	0
8/15/2005	20		0

MAL 1	MAL 2B	Statistics
4	6	10th percentile
3	5	min
20	27	geometric mean
150	170	max
98	115	90th percentile

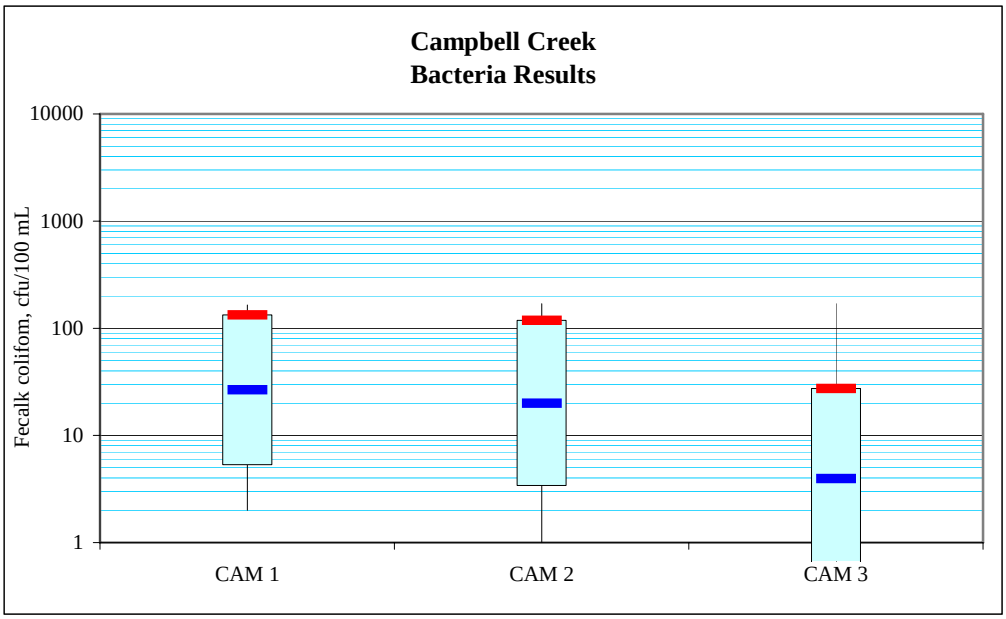
Figure 8. Malaney Creek Fecal Coliform Results



Date	UNC 1	UNC 2	UNC 3	Rainfall (Previous 24 hrs)
11/22/2004	110	54	20	0.01
12/8/2004	225	370	12	0.44
12/21/2004	39	13	8	0
1/4/2005	22	18	42	0
1/18/2005	200	150	240	1.25
2/18/2005	27	28	36	0
3/1/2005	140	49	2	0.1
3/8/2005	100	10	2	0
3/23/2005	15	13	20	0.04
4/5/2005	23	290	10	0.22
4/18/2005	48	14	24	0.26
5/3/2005	230	180	14	0.29
5/17/2005	220	450	190	0.14
5/31/2005	80	15	17	0
6/14/2005	66	22	21	0.06
6/27/2005	2300	110	13	0
7/5/2005	110	400	8	0
7/18/2005	100	60	10	0
8/1/2005	235	92	7	0
8/15/2005	240	230	20	0

UNC 1	UNC 2	UNC 3	Statistic
23	12	4	10th percentile
15	10	2	min
100	62	16	geometric mean
2300	450	240	max
439	336	74	90th percentile

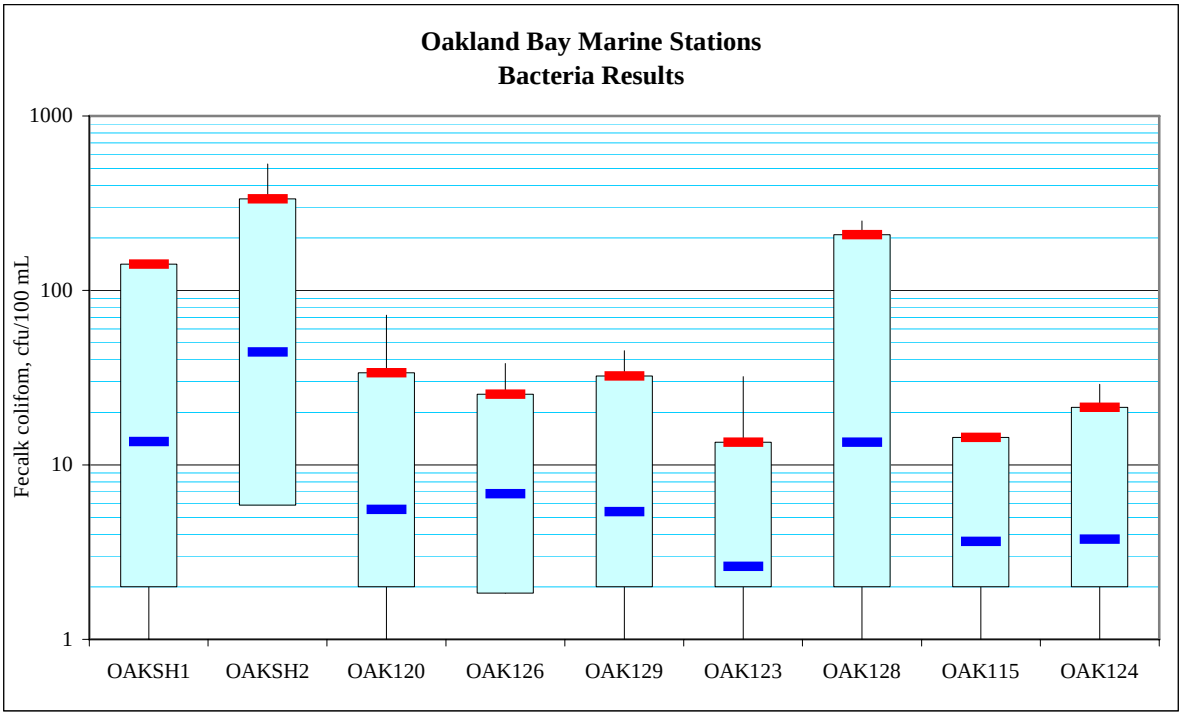
Figure 9. Uncle John's Creek Fecal Coliform Results



Date	CAM 1	CAM 2	CAM 3	Rainfall (Previous 24 hrs)
11/22/2004	4	36	1	0.01
12/8/2004	49	170	3	0.44
12/21/2004	5	6	2	0
1/4/2005	5	2	1	0
1/18/2005	120	88	6	1.25
2/18/2005	2	4	1	0
3/1/2005	31	49	1	0.1
3/8/2005	18	8	1	0
3/23/2005	6	1	1	0.04
4/5/2005	47	8	1	0.22
4/18/2005	165	6	1	0.26
5/3/2005	64	28	27	0.29
5/17/2005	140	68	5	0.14
5/31/2005	29	52	170	0
6/14/2005	37	11	9	0.06
6/27/2005	92	94	3	0
7/5/2005	35	30	4	0
7/18/2005	31	52	26	0
8/1/2005	29	38	31	0
8/15/2005	38	37	12	0

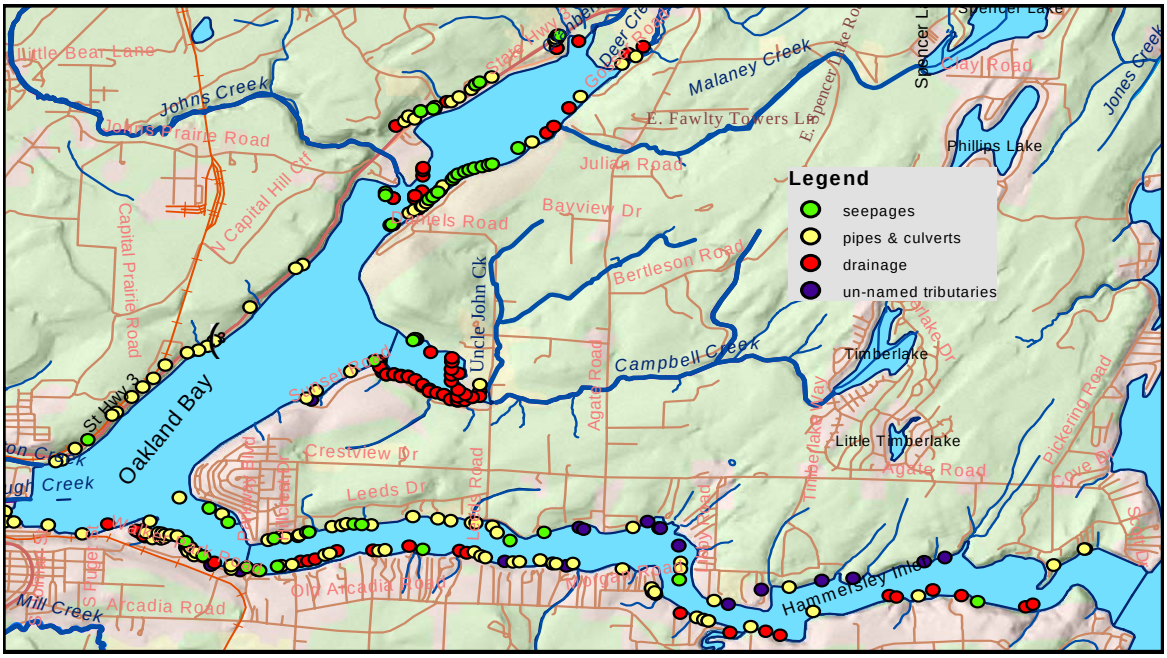
CAM 1	CAM 2	CAM 3	Statistic
5	3	1	10th percentile
2	1	1	min
27	20	4	geometric mean
165	170	170	max
133	118	27	90th percentile

Figure 10. Campbell Creek Fecal Coliform Results



Date	OAKSH1	OAKSH2	OAK120	OAK126	OAK129	OAK123	OAK128	OAK115	OAK124
11/2/2004	110	150	14	22	23	32	125	11	29
12/2/2004	31	11	2	5	2	5	6	3	1
1/5/2005	40	21	15	7	2	2	4	2	1
2/1/2005	5	9	5	9	3	1	1	13	1
3/1/2005	52	265	1	3	3	1	22	1	12
4/11/2005	1	20	3	2	1	1	1	1	2
5/10/2005	33	530	72	38	45	7	250	12	14
6/8/2005	1	17	2	3	19	1	67	3	4
Statistics	OAKSH1	OAKSH2	OAK120	OAK126	OAK129	OAK123	OAK128	OAK115	OAK124
10th percentile	2	6	2	2	2	2	2	2	2
min	1	9	1	2	1	1	1	1	1
geometric mean	14	44	6	7	5	3	14	4	4
max	110	530	72	38	45	32	250	13	29
90th percentile	142	335	34	25	32	13	209	14	21

Figure 11. Marine Station Fecal Coliform Results



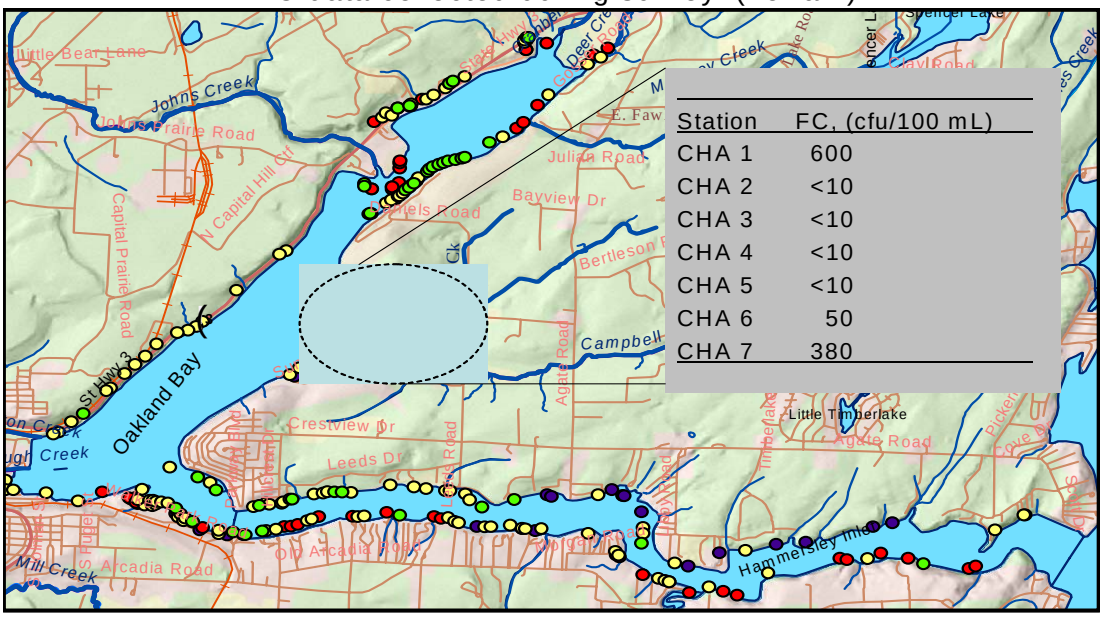
First Shoreline Survey results: **122 pipes/culverts,**
27 un-named tributaries,
87 drainages, and
43 seepages.

(no rain)

Surveyed on:
September 21, 2004

Figure 12. Drainage Locations

FC data collected during survey: (no rain)



Chapman Cove: Seepage = 3; Pipe = 4
Creek = 4; Drainages = 39

Figure 13. Chapman Cove Drainage Locatons

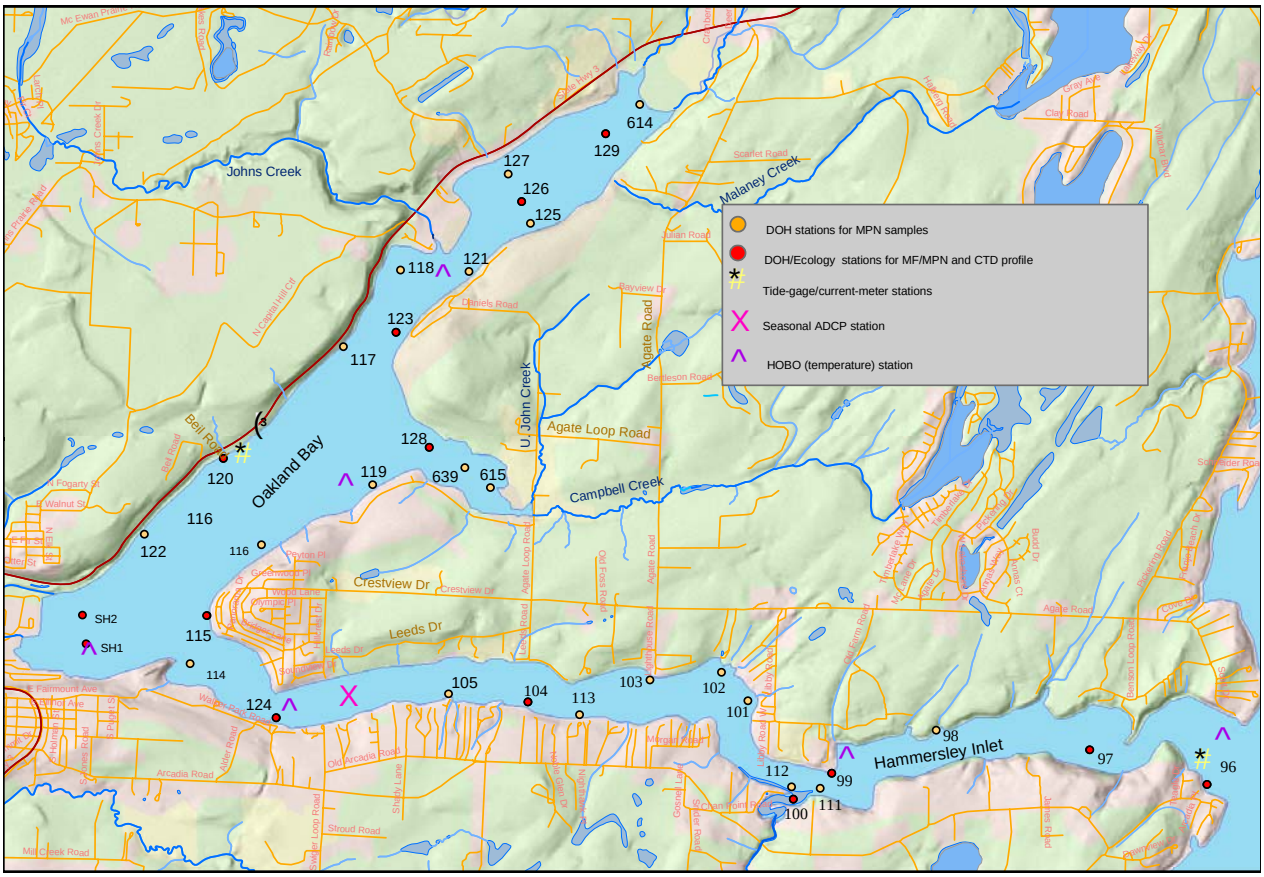


Figure 14. DOH/Ecology marine stations and locations of S4s and ADCP

Cc: Anise Ahmed, TMDL Project Manager
Karol Erickson, TMDL Bacteria Project Supervisor
Carol Norsen, Project Tracker Administrator